Indiana Department of Education
Indiana Academic Standards Course Framework

COMPUTERS IN DESIGN AND PRODUCTION

Computers in Design and Production is a course that specializes in using modern technological processes, computers, design, and production systems in the production of products and structures through the use of automated production systems. Emphasis is placed on using modern technologies and on developing career related skills for electronics, manufacturing, precision machining, welding, and architecture career pathways. Students use tools, materials, processes, and resources to create solutions as it applies in the areas of electronics, manufacturing, precision machining, welding, and architecture. The content and activities should be developed locally in accordance with available advanced technologies in the school. Course content should address major technological content related to topics such as: Architectural drawing and print design, design documentation using CAD systems; assignments involving the interface of CAD, CNC, CAM, and CIM technologies; computer simulation of products and systems; publishing of various media; animation and related multimedia applications; 3-D modeling of products or structures; digital creation and editing of graphics and audio files; control technologies; and automation in the modern workplace.

- DOE Code: 4800
- Recommended Grade Level: Grade 9-10
- Recommended Prerequisites: None
- Credits: A 1 credit per semester, maximum of 2 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- One of the courses specified in the sequence of courses for all Career Clusters and all of Indiana's College and Career Pathway Plans

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences.

Content Standards

Domain – Core Concepts

Core Standard 1 Students apply concepts of the design process using writing, math, and CAD skills for solving a design problem.

Standards

CPD-1.1 Identify components related to the design process.

CPD-1.2 Describe the steps in the design process.

CPD -1.3 Describe the elements and principles of design.

CPD -1.4 Make and use measurements in both traditional and metric units.

CPD -1.5 Apply and adapt the design process from conception through verification of a simple component or system.

CPD-1.6 Review CAD drawing design.

CPD-1.7 Demonstrate drafting concepts and the use of drafting tools.

CPD-1.8 Develop an understanding of geometry related to technical drawing and actual production objects.

CPD-1.9 Apply concepts of 3D CAD drawing and animation during the design process.

CPD-1.10 Use "real world" measuring tools and teaming concepts to create production models.

CPD-1.11 Solve technical mathematical problems.

CPD-1.12 Create multi-view drawings using 2D and 3D CAD.

CPD-1.13 Develop 3-D product models using solid modeling and parametric CAD software.

CPD-1.14 Understand concept sketching.

CPD-1.15 Create a presentation of a design using various methods.

CPD-1.16 Utilize Computer Aided Drafting (CAD) skills to produce drawings.

CPD-1.17 Identify common terms and definitions relating to Computer Aided Drafting.

CPD-1.18 Write a descriptive report on some aspect of the design process and how it relates to a project.

Domain – Electronics

Core Standard 2 Students verify electronic concepts for use in electronic schematics.

Standards

CPD-2.1 Design basic electronic schematics.

CPD-2.2 Identify and describe basic electronic laws.

CPD-2.3 Describe AC/DC concepts.

CPD-2.4 Apply basic logic found in electronics.

CPD-2.4 Identify symbols used in creating schematics.

CPD-2.5 Recognize and explain the functions of electronic components.

Domain – Advanced Manufacturing

Core Standard 3 Students integrate advanced manufacturing concepts in the design process to develop projects.

Standards

CPD-3.1 Apply the principles of mold design for a variety of products.

CPD-3.2 Identify necessary mold materials, stress and strength calculations, machining, fabricating, and testing in processing equipment needed to produce a product.

CPD-3.3 Describe the design of the manufacturing process as required by product design specifications.

CPD-3.4 Identify the selection of processes, tooling, work-holding, gauging, routing, and material handling, as developed for a manufacturing production simulation.

CPD-3.5 Demonstrate process planning; cost and efficiency analysis.

CPD-3.6 Demonstrate planning for ergonomics, robotics, machine tools, coordinate-measuring machines, and custom automation for a product.

CPD-3.7 Use simulation software to design a factory layout and material-flow simulation.

CPD-3.8 Design for product-ability and manufacturing ease.

CPD-3.9 Understand how robots operate in a work cell.

CPD-3.10 Incorporate print reading for applications.

Domain – Precision Machining

Core Standard 4 Students choose precision machining concepts to use in creating a solution.

Standards

CPD-4.1 Explain the practical considerations associated with the use of FEA (Finite Element Analysis) with respect to product stress and strain analysis.

CPD-4.2 Identify geometric dimensioning and tolerancing, and surface texture specifications.

CPD-4.3 Identify a wide range of rapid prototyping technologies and materials.

CPD-4.4 Explain why rapid prototyping is a useful technique in designing a product.

CPD-4.5 Convert/create products using modeling software, convert drawings using appropriate software and produce a product using a rapid prototyping technique.

CPD-4.6 Demonstrate the ability to model/prototype to scale.

CPD-4.7 Understand and practice orthographic projection drawings as related to practical applications.

CPD-4.8 Understand and practice axonometric projection drawings as related to practical applications.

CPD-4.9 Demonstrate robotics programming and CAD/CAM/CNC programming for producing the instruction codes necessary to manufacture parts with NC machine tools are emphasized.

CPD-4.10 Incorporate precision tool reading for applications.

CPD-4.11 Show understanding of coordinate systems.

Domain – Welding

Core Standard 5 Students recommend welding methods to be used on a particular type of material in accordance to the use of the product.

Standards

CPD-5.1 Identify welding types through finite/stress analysis.

CPD-5.2 Incorporate print reading for applications.

CPD-5.3 Identify welding symbols used on drawings.

CPD-5.4 Describe different types of welding.

Domain – Architecture

Core Standard 6 Students integrate architecture concepts in the design process to develop projects.

Standards

CPD-6.1 Demonstrate an understanding of various historical house styles.

CPD-6.2 Assess space planning for occupant use.

CPD-6.3 Recognize and explain how building codes and ordinances affect design.

CPD-6.4 Identify the drawings required for residential construction.

CPD-6.5 Create architectural blueprints.

CPD-6.6 Select the appropriate scale using an architect's scale.

CPD-6.7 Identify and apply architectural symbols used on drawings.

CPD-6.8 Identify the proper use of site analysis.

CPD-6.9 Demonstrate knowledge of roof systems, terminology, style, and construction.

CPD-6.10 Identify various styles of roof systems.

CPD-6.11 Explain the purpose of elevations.

CPD-6.12 Evaluate different foundation systems and terminology.

CPD-6.13 Analyze mechanical systems present in residential construction.

Domain – Careers in Electronics, Advanced Manufacturing, Precision Machining, Welding, and Architecture.

Core Standard 7 Students evaluate potential career opportunities in electronics, advanced manufacturing, precision machining, welding, and architecture.

Standards

CPD-7.1 Research electronics, advanced manufacturing, precision machining, welding, and architecture careers.

CPD-7.2 Find electronics, advanced manufacturing, precision machining, welding, and architecture opportunities offered by a technical school or college.

CPD-7.3 Determine electronics, advanced manufacturing, precision machining, welding, and architecture occupation wages/salaries.

CPD-7.4 Research electronics, advanced manufacturing, precision machining, welding, and architecture job outlook information.

Process Standards

Reading Standards for Literacy in Technical Subjects 9-10

The standards below begin at grade 9 and define what students should understand and be able to do by the end of grade 10. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Key Ideas and Details

9-10.RT.1 Cite specific textual evidence to support analysis of technical texts, attending to the precise details of explanations or descriptions.

9-10.RT.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

9-10.RT.3 Follow precisely a complex multistep procedure when performing technical tasks, attending to special cases or exceptions defined in the text.

Craft and Structure

9-10.RT.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to *grades 9-10 texts and topics*.

9-10.RT.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

9-10.RT.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

Integration of Knowledge and Idea

9-10.RT.7 Translate technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

9-10.RT.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a technical problem.

9-10.RT.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Range of Reading and Level of Text Complexity

9-10.RT.10 By the end of grade 10, read and comprehend technical texts in the grades 9-10 text complexity band independently and proficiently

Writing Standards for Literacy in Technical Subjects 9-10

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Text Types and Purposes

9-10.WT.1 Write arguments focused on *discipline-specific content*.

9-10.WT.2 Write informative/explanatory texts, including technical processes.

9-10.WT.3 Students will not write narratives in technical subjects. *Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In technical, students must be able to write precise enough descriptions of the step-by-step procedures they use in their technical work that others can replicate them and (possibly) reach the same results.*

Production and Distribution of Writing

9-10.WT.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

9-10.WT.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

9-10.WT.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Research to Build and Present Knowledge

9-10.WT.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

9-10.WT.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectivity to

maintain the flow of ideas, avoiding plagiarism and following a standard format for citation

9-10.WT.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

9-10.WT.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.